Upgrading (and Retrofitting) Wastewater Facilities

John Harkins

Water Management Division

Upgrading (and Retrofitting)Wastewater Facilities

- Collection and Transmission Systems
- Treatment Systems

Increase capacity

- Increase capacity
- Meet more stringent limits

- Increase capacity
- Meet more stringent limits
- Extend useful life

- Increase capacity
- Meet more stringent limits
- Extend useful life
- Bring into compliance

Goals for Upgrading:

Compliance, Capacity, Performance

Goals for Upgrading:

Compliance, Capacity, Performance all lead to:

Infrastructure Asset Management

- GASB Statement 34
- ISO 14001 Standard

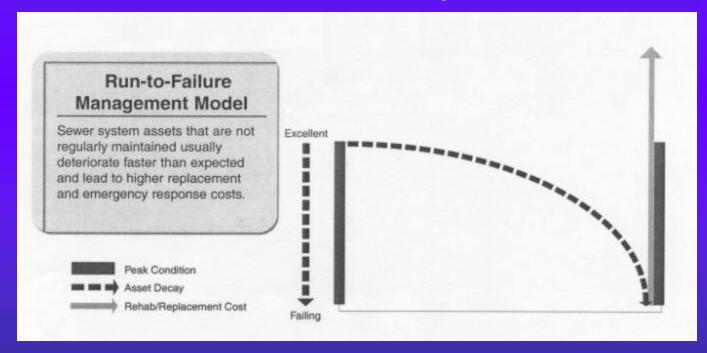
GASB 34

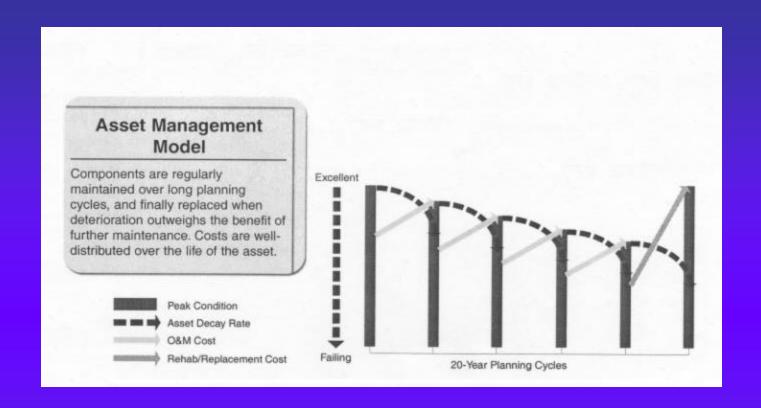
- Infrastructure must be counted as an Asset
- Depreciate assets or maintain performance level
- Performance level > compliance level

WASTEWATER INFRASTRUCTURE ASSETS

57.5% are over 20 years old

16.5% are over 50 years old





WASTEWATER INFRASTRUCTURE ASSET MANAGEMENT

ISO 14001

- International Standards
- Environmental Management Systems
- Assessments, Audits and Performance Evaluations

Infrastructure Asset Management

Wastewater Collection and Treatment Systems

- Condition Assessment
- Performance Evaluation
- Rehabilitation (Upgrade)
- Proper Management, Operation and Maintenance (MOM)

Treatment Systems

Condition and Performance Assessment

Comprehensive Performance Evaluations

Composite Correction Program Approach

EPA/625/6-84/008

Retrofitting POTWs

EPA/625/6-89/020

United States Environmental Protection Agency Center for Environmental Research Information Cincinnati OH 45268

Technology Transfer



Handbook

Improving POTW
Performance Using the
Composite Correction
Program Approach

Composite Correction Program (CCP) Approach

United States Environmental Protection Agency Center for Environmental Research Information Cincinnati, OH 45268

Technology Transfer

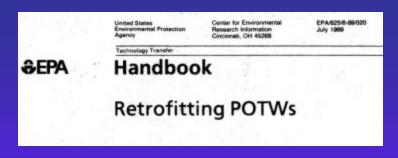
Handbook

Retrofitting POTWs

Comprehensive Performance Evaluation (CPE)



- Design, Construction, Management, Operations, and Maintenance
- Overloading, I/I, Pretreatment, Spare Parts, Laboratory, Budget, Staffing



- Conducting Comprehensive Performance Evaluations
- Conducting a Composite Correction Program
- Facility Modifications
- Data Collection Sheets & Procedures

Classification of PLFs

United States Environmental Protection Agency Center for Environmental Research Information Cincinneti, OH 45268 EPA-625/6-89/020 July 1989

⊕EPA

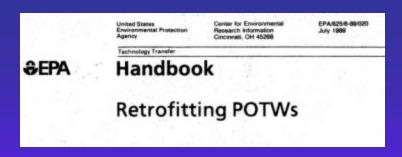
Handbook

Retrofitting POTWs

Classification System for Prioritizing Performance-Limiting Factors*

Rating	Adverse Effect of Factor on Plant Performance
Α	Major effect on a long-term repetitive basis
В	Minimum effect on a routine basis or major effect on a periodic basis
С	Minor effect
NR	No Rating - factor has no adverse effect on plant performance (i.e., satisfactory assessment of this potentially performance-limiting item)

Procedures and Data Collection



- CPE Ranking of PLFs
- Data Collection Sheets
 - Administration

• Maintenance

Design

Performance

Operations

- Interviews
- Ranking Procedures and Calculations
- Sample Programs and Forms

Data Collection Sheets

	Primary Treatment		
rimary Clarifor(s)			
Number	Surface Dimensions		
Water Depth (Shallowest)	R×0.3 =	_ m	-
Water Depth (Deepest)	#×0.3 =	m	
Weir Location			
Wer Length	# × 0.3 *	m	
Total Surface Area	sq ft x 0.093 =	m2	
Total Volume	cu ft x 0.028 =	_m3	
Flow (Design)	mgd x 3,785 =		
(Operating)	mgd x 3,785 =	m ³ ·d	
Weir Overflow Rate (Design)	gpd:ft x 0.012 =	m ² md	
(Operating)	gpdft x 0.012 =	m ³ imid	
	gpd/sq H x 0.04 =		
(Operating)	gpd/sq ft x 0.04 =	b/m/m	
Collector Mechanism Name	11111		
Model	Horsepower		
Soum Collection and Treatment:			
Soum Volume:			
Soum Treatment/Disposal:			

United States Environmental Protects Agency Technology Transfer Center for Environmental Research information Cincinnati, OH 45268 EPA-625/6-89/020

⊕EPA

Handbook

Retrofitting POTWs

	SecondaryTreatment (Oxygen Supply)
lurtace Mechanical Aeration No. of Aeration	Name	
Model	Horsepower	
Rated Capacity	Ib/hr x 0.454 =	ighr.
Speed Control:		
Submergence Control:		
Mused Aeradon Blowers No. of Blowers	Namo	
Model	Horsepower	
Capacity	ofm = 0.028 =	num Fen
Minimum Inlet Air Yemperatur Offlusers Types of Offlusers (course, fi	ne peramet, stainless steel, etc.):	
Offluenz Types of Diffusers (coerse, fill Manufacturer	no, peramet, stainless steel, etc.): Model	
Offlusers (coarse, fill Manufacturer Water Copth	ne, peramet, steinless steel, etc.): Model	
Official Types of Official (coarse, file Manufacturer Water Cooth Rated Standard Translet Effic	ne, ceramin, stainless steel, etc.): Model	
Offlusers Types of Diffusers (coarse, fi Manufacturer Waser Depth Rated Standard Transfer Effic Water Temperature (mesimum	ne, ceramis, stainless steel, etc.): Model Hency	
Offlusers Types of Offlusers (coarse, fi Manufacturer Wasser Depth Rated Standard Transfer Effic Water Temperature (masimum	ne, ceramin, stainless steel, etc.): Model	
Offlusers Types of Offlusers (coarse, fi Manufacturer Waser Depth Rated Standard Transfer Effic Water Temporature (maximus Plant Elevation	ne, ceramit, stánicas steel, etc.): Model Liency Til	
Official Types of Diffusers (coarse, fi Manufacturer Water Cepth Rated Standard Transler Effic Water Temperature (maximus Plant Elevation et Aerabon	ne, ceramit, stánicos steel, etc.): Model Siency Name	
Official Standard Transfer Effic Water Depth Transfer Effic Water Temperature (maximus Plant Elevation et Aeration No. of Aerations Model	ne, ceramit, stánicos steel, etc.): Model Siency Name	
Official Standard Transfer Effic Water Depth Transfer Effic Water Temperature (maximus Plant Elevation et Aeration No. of Aerations Model	None	
Offluens Types of Diffusers (coarse, fi Manufacturer Waser Depth Rated Standard Transler Effic Water Temperature (maximum Plant Elevation lot Aeration Mo. of Aerators Model Rated Capacity	None	

Procedures and Calculations

Appendix M. Trickling Filter Major Unit Process Evaluation Worksheet This worksheet is used to evaluate the capability of existing major unit processes, i.e., sersitor, secondary climiter, and sludge handling system. Key loading and process parameters are compared with standard values and point scores are assigned. These points are subsequently compared with expected point scores for Type 1. Type 2, and Type 3 facilities, and a determination of the plant Type is made. Instructions for use: . Proceed through the steps contained in this worksheet in order. . Use actual values in lieu of calculations if such data are available and appear reliable, e.g., waste sludge . When assigning points, interpolate and use the nearest whole number. . Minimum and maximum point values are indicated - do not exceed the range illustrated. Calculate Equivalent Filter Media Volume: "Aerator" Media Volume Rock Filter Media Specific Surface Area 13 sq fricults Calculate BOD₅ Loading Primary Efficient BOOs BDOs Leading = -Enoyatient Filter Media Volume BOOs Leading = -Determine BODs Loading Point Score: BOOs Landing (first 1,000 ov fo. Freezing Temperatures Covered Fitter Northweeting Temperatures. Points BODy Loading Point Score

United States Environmental Protection Agency Technology Transfer Center for Environmental Research information Cincinnati, OH 45268 EPA625/6-89/020 July 1989

⊕EPA

Handbook

Retrofitting POTWs

		m G-1 formation Sheet		
		Plant Equipme	ont Number	7.00
Equipment:				
Location		Original Installation Dat		
Manufacturer	Model	Serial No.	_	
Type	Rened Capacity	Ranad Pre	essure or Head	
Additional Data				
Drive Type	M	snufacturer		
Description				
Frame	Enclosure Ty	pe	S.F	
Туре	Reted Amperage	Flored Vol	tage	
Suppliers Company Name & Addre		Contact Person		Zelephone.N
Market A				
THE REAL PROPERTY.				

United States Office of Water OMPC-10.89
Environmental Protection (WH-548) April 1989
Agency

ŞEPA

A	Poor Understanding and application of process control by operator
В	Staffing (too few staff, low pay, turnover, etc.)
C	Support from municipality (administrative and technical)
D	Operating budget and user charge system
E	Operability and maintainability considerations (process flexibility, automation, standby units, etc.)
F	Infiltration/Inflow
G	Construction problems
H	Process design errors (clarifiers, aerators, disinfection, etc.)
	Over design
J	Under design
K	Solids handling and sludge disposal
L	Pretreatment, industrial discharges, and toxics
M	Operation and maintenance manual
N	Preventive maintenance program
0	Spare parts inventory
P	Chemical inventory
Q	Laboratory capability for process/NPDES testing
R	NPDES reporting
S	Equipment/Unit process broken down/inoperable
	Hydraulic overload
U	Poor aeration system

United States Environmental Protection Agency Office of Water (WH-548) OMPC-10-88 April 1989

ŞEPA

Table 1.2	70.00	Nost Fre		Occu	rring
Region I	A**	K	С	В	F
Region II	Α	K	F	Н	N
Region III	Q	Α	K	F	В
Region IV	A	K	F	Q	В
Region V	Α	K	F	Q	В
Region VI	A	С	K	В	F
Region VII	A	Q	K	В	F
Region VIII	Α	N	С	Н	K
Region IX	A	N	K	Q	Н
Region X	A	C	Q	F	н

United States Office of Water OMPC-10.89
Environmental Protection (WH-548) April 1989
Agency

ŞEPA

A	Poor Understanding and application of process control by operator
В	Staffing (too few staff, low pay, turnover, etc.)
C	Support from municipality (administrative and technical)
D	Operating budget and user charge system
E	Operability and maintainability considerations (process flexibility, automation, standby units, etc.)
F	Infiltration/Inflow
G	Construction problems
H	Process design errors (clarifiers, aerators, disinfection, etc.)
	Over design
J	Under design
K	Solids handling and sludge disposal
L	Pretreatment, industrial discharges, and toxics
M	Operation and maintenance manual
N	Preventive maintenance program
0	Spare parts inventory
P	Chemical inventory
Q	Laboratory capability for process/NPDES testing
R	NPDES reporting
S	Equipment/Unit process broken down/inoperable
	Hydraulic overload
U	Poor aeration system

United States
Environmental Protection Agency

Office of Water (WH-548) Office of Water (WH-548

tem	Type of Process Unit	Primary or Secondary Performance Limitation	Number of Times Cited*
A.	Inlet Works	Secondary	13
В.	Primary Clarifier	Primary	2
C.	Aeration Basins	Secondary	6
D.	RBC or Trickling Filter	Secondary	10
E.	Lagoon	Secondary	3
F.	Secondary Clarifler	Secondary	5
G.	Disinfection	Primary Secondary	2 8
H.	Sludge Transport	Secondary	2
I.	Sludge Dewatering	Secondary	15
J.	Sludge Digestors	Primary Secondary	2 3

Treatment Systems

Common Upgrades

Hydraulic Capacity: Equilization basins, additional clarifiers, I/I reduction

- Excessive Loading: Pretreatment, increased aeration, additional clarifiers
- Nitrification: Replace fixed media, additional aeration basins, slow rate filters
- Phosphorus: Chemical addition, biological process control, filters

Collection and Transmission Systems Condition Assessment

Sewer System Evaluation Survey

Sewer System Infrastructure Analysis and Rehabilitation

EPA/625/6-91/030

United States Environmental Protection Agency

Technology Transfer

Office of Research and Development Cincinnati, OH 45268 EPA/625/6-91/030 October 1991



Handbook

Sewer System
Infrastructure Analysis and
Rehabilitation

Sewer System Evaluation Survey (SSES)

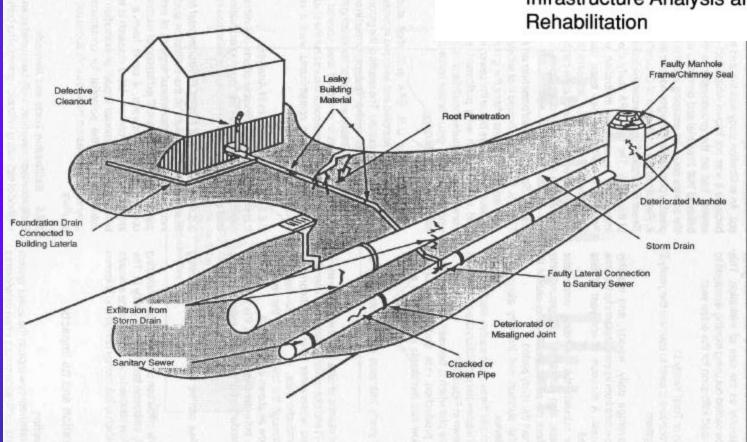
Common Sewer Problems

SEPA Handbook

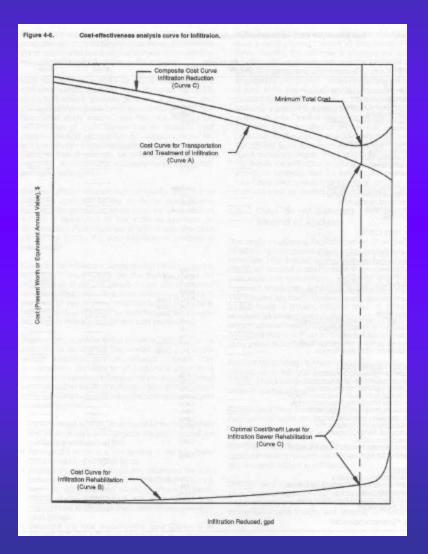
Sewer System
Infrastructure Analysis and Rehabilitation

EPA625/6-91/000

United States



Cost-Effective Solutions



Chicke of Recearch and Development Colobber 1991

SEPA

Handbook

Sewer System
Infrastructure Analysis and Rehabilitation

The Cost to Remove
I/I is Compared to the
Cost to Transport and
Treat All of the
Remaining Flow

Collection and Transmission Systems Condition Assessment

- Hydraulics
 - Flow Monitoring
 - Peak Flow/Capacity Assessment
 - I/I Analysis
- Physical Condition
 - Pipes/Manholes/Stream Crossings
 - Pump Stations/Force Mains
 - Priority Rating System

Resources - Ordering Manuals

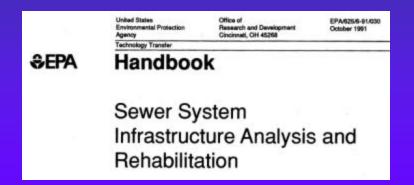
Genter for Environmental Protection Agency

Technology Transfer

Handbook

Improving POTW

Performance Using the Composite Correction Program Approach



United States
Environmental Protection Research Information
Agency
Technology Transfer

Handbook

Retrofitting POTWs

www.epa.gov/ttbnrmrl/

Resources - (Fact Sheets On-line)



www.epa.gov/owm/mtbfact.htm

EPA Region 4, Water Management Division Water Programs Enforcement Branch

Management, Operation and Maintenance (MOM) Program

www.epa.gov/region4/water/wpeb/momproject/index.html

John Harkins (EPA Region 4): (404) 562-9758